DOCUMENT RESUME

ED 214 067 CG 015 802

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TITLE The Potency of Primary Prevention: A Meta-Analysis of Effect Size.
PUB DATE 25 Apr 81
NOTE 18p.; Paper presented at the Annual Meeting of the Eastern Psychological Association (52nd, New York, NY, April 22-25, 1981).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Community Programs; Data Analysis; Decision Making; *Evaluation Methods; *Information Needs; Intervention; *Prevention; *Program Effectiveness; *Psychology; *Research Needs
IDENTIFIERS *Effect Size

ABSTRACT

Primary prevention is a major concern in psychology, but data regarding intervention effectiveness, particularly effect sizes (ES) appear to be lacking. A thorough literature search of Psychological Abstracts, community psychology journals, and textbooks yielded 47 primary prevention articles, 22 of which were data-based, and none of which reported estimates of ES. In terms of data availability, only 13 articles were found for which an ES could be calculated. Reanalysis of 43 significant positive effects from 11 studies revealed a wide variability of ES. Effect sizes ranged from less than 1% to 40%, with a mean of 8%. Data demonstrated a wide variability in the impact of primary preventative effects. The findings suggest that accurate reporting of ES may be valuable in helping to improve the precision of evaluative and decision-making procedures. (Author/NRB)

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# The Potency of Primary Prevention:

# A Meta-analysis of Effect Size

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CG 015 802

Presentation to the Annual Meeting of the Eastern Psychological Association, April 25, 1981, New York.

# The Potency of Primary Prevention:
# A Meta-analysis of Effect Size

Primary prevention is a current concern among laypersons and professionals alike who support the development and expansion of preventive programs. However, it appears that the bulk of the literature regarding primary prevention involves theoretical or anecdotal description rather than empirical evaluation. Thus, a major concern of this study was to identify the empirical data supporting primary prevention. More importantly, we asked, "How large, i.e., how powerful are the effects of programs identified as primary preventative?" Our concern for effect size (ES) emerged from the recent call for a paradigm shift by methodologists who argue that statistically significant effects may be of little practical significance (Bakan, 1967, pp. 123-125, or Cohen, 1965, p. 101 and p. 119). Such methodologists assert that authors should report estimates of ES (e.g., omega squared, eta squared or $C^2$) for their results whenever possible.

The issue is far from trivial with respect to primary prevention as it touches on both the economic and practical concerns of specific programs. For instance, an intervention may, indeed, have produced a significant change in a target behavior; but, if the intervention only accounted for a minute proportion of the variance, it would be of little practical significance despite its statistical significance. (Unless, of course, it was virtually cost-free in terms of time and money.) In fact, the danger in omitting ES measures has been demonstrated by Craig, et al. (1976): They conclude that 10% of the effects sampled from articles in prestigious journals were of minimal magnitude. More recently, Susskind and Reid (1980) identified 83 "core" articles in community psychology--where core articles were those which

were cited in at least three of five major texts in community psychology. They drew the following conclusions. First, only 23 of those articles were data-based; secondly, none of those 23 studies reported ES's; thirdly, they concluded that the community psychological studies yielded an average ES of 7.5%. This value lies in the medium to large effect range according to criteria suggested by Cohen (1969).[1] The five largest effects ranged from 19% to 29%. Finally, there were a number of studies with trivial ES's where the author totally ignored the issue of ES.

Rather than look generaly at community psychology, the present investigation narrowed its focus to the primary prevention literature and addresed four issues similar to those of Susskind and Reid (see Section II on the handhout). For the first issue, breadth of the data base, we asked, "What percent of the articles are data-based (i.e., utilize inferential statistics) as opposed to theoretical or anecdotally descriptive?" For our second issue, data availability, we asked, "What percentage of the data-based articles: (1) supply estimates of ES; (2) supply sufficient data for the calculation of an ES, and (3) do not supply sufficient data for the calculation of an ES?" To address the third issue of potency, we asked, "How large are the ES's in primary prevention?" Finally, being concerned with the awareness of potency, we asked, "Do authors take ES into consideration when drawing conclusions?"

Criteria for Selection

In order to gather a representative sample of articles, a thorough search of the literature was undertaken by using multiple points of entry. Articles were included in our sample if they met either of two criteria: (1) the article was explicitly, publicly proclaimed to deal with primary prevention (i.e., its authors so stated, or else it was cited by others as an

example of primary prevention); (2) although the article did not meet criterion (1), we judged the article to meet the Caplan and Grunebaum (1967, p. 331) definition of primary prevention.

Search Procedure

The literature search, itself, was a three-stage process (see Section III on the Handout). Initially, we consulted four popular texts in community psychology (Bloom, 1975; Munoz, Snowden, Kelly, et al., 1979; Rappaport, 1977; Zax & Specter, 1974). We first examined those sections related to primary prevention and then "eyeballed" the reference section of each book for additional articles. In the second stage, we searched the Psychological Abstracts from 1970 to 1980 under the topics of primary prevention, prevention and other related topics (such as mental health, community mental health and community psychology). Finally, we searched the indices of four major journals in community psychology from 1970 (when available) to 1980. These journals were: the American Journal of Community Psychology, the American Journal of Orthopsychiatry, the Community Mental Health Journal, and the Journal of Community Psychology.

Once the initial sample of articles was selected, we removed those articles that dealt only with secondary or tertiary, but not primary, prevention. These primary preventative articles were then classified on three levels (see Section IV of the Handout). The first level was theoretical (i.e., writing on a conceptual, "as if" level, but lacking descriptive or concrete data). The second level was descriptive (i.e., presenting an actual, specific intervention, but not providing any inferential statistics or sufficient data to perform statistical tests). The third level was data-based (i.e., providing numerical data which allows the application of inferential statistics).

We then selected those articles which provided estimates of ES or which provided sufficient data to calculate an ES. If an article did not supply sufficient data, we wrote to the author and requested additional data. Finally, we calculated an ES for all statistically significant effects which tested hypotheses concerning primary prevention.

Results

In all, we identified 47 articles as being relevant to primary prevention. (These articles are contained in the reference list and are indicated by an asterisk.) Note: We were struck and bothered by the small number of primary prevention articles and rechecked our search. Nonetheless, we came up with only 47 articles. (In fact, we would appreciate it if you could provide us with the feedback requested on the last page of the handout.) One of our findings, then, is that, rhetoric notwithstanding, community psychology has produced relatively few articles dealing with primary prevention. With respect to our first issue, breadth of the data base, we found that of the 47 articles, 28% were theoretical, 26% were descriptive, and 47% or 22 of the 47 articles were data-based. While the literature does not appear to be overlaiden with theory, there is a marked shortage of inferential data demonstrating the efficacy of primary prevention.

With respect to the second issue, data availability, we found that, of the 22 data-based articles, none reported estimates of ES (although Bloom, 1971, alluded to ES). Even when we tried to calculate ES, more than half of the articles (14 out of 22) provided too little data, leaving 8 articles for which an ES could be calculated. As the result of our letter to authors requesting additional data, we were able to estimate ES's for 5 additional articles. Thus, we had a total of 13 articles for which an ES could be calculated. These findings suggest: (1) authors routinely fail to utilize

ES statistics; (2) further, they routinely fail to report sufficient data which would allow the reader to calculate an ES.

Our third issue, potency, was concerned with the size of effects in primary prevention. The estimates of ES for the 13 articles are summarized in Table 1. This table supplies the mean and median ES (when more than one

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Insert Table 1 about here

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dependent variable was examined), the range of values, the number of dependent variables (N) used, and the direction of the findings (i.e., positive if the treatment group improved and negative if the treatment group performed more poorly than the control group). As the table indicates, only two of the articles displayed negative results. When considering all of the effects that we identified in the 11 data-based articles, which exhibited positive results (N = 43), we found that the amount of variance accounted for ranged from less than 1% to 40% with the mean being 8%. When we considered the average ES of each article, the range of variance accounted for was 1% to 32%, with the mean being 9% and the median being 5%. Therefore, it would appear that, on the average, the empirical research in primary prevention is accounting for 5% to 9% of the variance, which is, by Cohen's standards, in the moderate ES range. This average is comparable to that of community psychology, in general, according to Susskind and Reid. Finally, to answer the question of awareness of potency, we found that, as previously noted, no authors reported estimates of ES. However, Bloom (1971) did make a subjective reference to the size of his effects. Still, the other authors failed to even make a subjective statement concerning ES.

Implications

Despite the apparent power of primary prevention, the range of ES estimates indicates that this "potency" cannot be taken for granted. Therefore,community psychology needs to become more concerned with the reporting of ES estimates in primary prevention research. In fact, there is the more general need to attend to empirical evaluation of interventions.

The calculation of an ES can be an invaluable tool for assisting in the determination of an intervention's utility. For example, it is not enough to say that an intervention "makes a difference." More importantly, it is necessary to determine just how much of that difference can be attributed to the intervention. Not only will consideration of ES reduce the likelihood of weak programs being maintained due to misleading inferential statistics, but it will enable the researcher to give credit where credit is due. (After all, if you've got it, flaunt it!) Vogelsong et al. is a case in point, in that their intervention accounted for as much as 40% of the variance and they failed to bring this to the attention of their readers.

The magnitude of effect is also of importance when nonsignificant results arise. Since ES is not affected by statistical significance, an estimate of ES can help to determine whether there appears to be a sizeable effect which failed to reach statistical significance due to insufficient power (such as a small sample size), or whether, in contrast, our best estimate of ES indicates the effect is small and not worthy of increasing the sample size.

To conclude, there are two points to stress. First, methodologically, we are sufficiently equipped to utilize ES on a sophisticated level. While the estimation of ES is not yet applicable to all statistical procedures, we do have the means to apply it to the more common statistical tests. In fact,

we are aware of at least 12 "how-to-do" articles published in the psychology literature from 1965 to 1974, as well as a recent article by Susskind and Howland (1980). (These articles are listed in the handout.) We hope that our paper has convinced you that it is time to learn these procedures. In the interim, there is a second alternative, i.e., that the author at least provide sufficient data to enable a reader to calculate an ES. This data includes the sample size(s), the degrees of freedom, the value of the test statistic, and all of the mean squares or sums of squares for ANOVA designs (including error terms and subject effect in repeated measures designs).

Our second point is that it is extremely important to report ES. Practically speaking, with money and other reesources becoming scarce, it is essential that we neither falsely accept programs whose effects are small, at best; nor that we falsely reject programs which are capable of producing large effects. To this end, the application of ES is invaluable. Just as the addition of inferential statistics to our methodological repertoire vastly improved the science of psychology, so, too, will the addition of ES as a routine procedure help us to improve the precision of our evaluative and decision-making procedures.

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## Footnotes

[1]According to criteria proposed by Cohen (1969, p. 24), an effect size of .14 or more is considered a large effect in psychological research.

[2]These include, in chronological order: Cohen (1965), Friedman (1968), Fleiss (1969), Glass and Hakstian (1969), Vaughn and Corballis (1969), Kennedy (1970), Holderson and Glasnapp (1972), Cohen (1973), Dodd and Schultz (1973), Gaito and Firth (1973), Levin (1973), and Dwyer (1979).

Table 1

Summary of Effect Size Estimates

| Author | Number of Dependent Variables[a] | Range | Mean | Median | Direction | Average Sample Size |
|---|---|---|---|---|---|---|
| Arco et al, 1979 | 3 | .04-.07 | .05 | .05 | Positive | 20 |
| Bloom, 1971 | 3 | <.01-.08 | .03 | <.01 | Positive | 169 |
| Cowen et al, 1979 | 5 | .02-.03 | .03 | .03 | Positive | 248 |
| Cowen et al, 1963 | 5 | .01-.02 | .01 | .01 | Positive | 175 |
| Cowen et al, 1966 | 7 | .02-.21 | .08 | .08 | Positive | 114 |
| Hartman, 1979 | 4 | .03-.19 | .07 | .04 | Positive | 121 |
| McCord, 1978 | 5 | .01-.10 | .04 | .02 | Negative | 194 |
| McGuire & Gottlieb, 1979 | 3 | .04-.11 | .07 | .07 | Positive | 45 |
| Ojeman, 1960 | 1 | | .20 | | Positive | 140 |
| Schnelle et al, 1977 | 4 | .03-.13 | .09 | .10 | Positive | 71 |
| Shure & Spivack, 1979 | 5 | .03-.07 | .05 | .05 | Positive | 126 |
| Vogelsone et al, 1979 | 3 | .23-.40 | .32 | .34 | Positive | 8 |
| Williams & Polak, 1979 | 4 | .09-.12 | .11 | .11 | Negative | 48 |
| Summary: Median Across 13 studies | | | .07 | .07 | | |
| Summary: Mean Across 43 Effects | | | .08 | | | |

[a]We selected all statistically significant effects which tested a hypothesis concerning primary prevention.